K40 Postmortem Redistribution of Phenobarbital: A Rat Suicide Model

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After attending this presentation, attendees will retain the importance of postmortem redistribution of phenobarbital (barbiturate), will understand grossly how redistribution works in a cadaver, and will learn some of the forensically important insect species in south-eastern Greece.

In this rat suicide model, phenobarbital is being used. It belongs to a category of drugs of which postmortem redistribution has not been studied for a long time. This presentation will impact the forensic community and/or humanity by demonstrating how the postmortem redistribution of a drug with this kind of profile is important to be known by a forensic toxicologist or forensic pathologist, so as to be able to interpret the results of blood, body fluids, and solid tissue samples.

Drug concentrations found in toxicological analyses of postmortem tissue, body fluids, and blood samples can lead to erroneous conclusions without the proper interpretation by the forensic pathologist, resulting in liability claims, insurance denials, and significant emotional turmoil for all involved. Postmortem redistribution of a drug may be the basis for elevated or toxic drug concentrations after death.

Postmortem redistribution refers to the processes by which diffusion of drugs and other chemicals takes place after death, from the gastrointestinal tract and solid organs to blood and other body fluids and vice-versa. This phenomenon is well recognized, and was first reported 25 years ago. Since then a considerable effort has gone into elucidating the processes responsible. Consideration of the redistribution of drugs is important in a variety of situations. Cases of suspected poisoning (either homicidal or suicidal) or cases where the drug concentrations are in the threshold of toxicity, as in vehicle accidents, and also potential cases of euthanasia or medical negligence, may rely absolutely upon the validity of toxicological analyses of blood and tissue samples obtained postmortem.

In this study, a suicide simulation model, 54 wistar rats were separated in six groups. In each experiment, six rats were sacrificed by intraperitoneal infusion of 300mg of phenobarbital dissolved in double distilled water (ddH_2O), and three by neck dislocation (controls). Each group was then exposed in open air for a different period of time: 0, 4, 5, 6, 7 and 8 days. At the times indicated the bodies were collected, and various carrion tissues (liver, kidneys, lungs, heart, and bloody fluid) and scavenger insect larvae were taken away for further analyses. For the toxicological analyses of the specimens (bloody fluid, tissue and larvae extracts), a Cobas Integra 400 plus (Roche Diagnostics) was used. This automatic analyzer performs measurements for the quantitative determination of drug concentrations using fluorescence polarization immunoassay (FPIA). In addition, scavenger insects were collected from the experimental scene, preserved in Kahle's solution, and were grouped and identified. Analytical climatological data were recorded, i.e. temperature (T, °C), relative humidity (RH, %) and rainfall height (r, mm), on an hourly basis.

The results indicate that there is a strong time-dependent linear increase in the levels of phenobarbital in the bloody fluid, heart, and lungs. In liver and kidneys a similar increase is initially noticed, but after the fifth day it is followed by linear decrease.

In larvae the decrease commenced the sixth day. The insects collected belong to the orders of diptera, coleoptera, and hymenoptera. The dominant order was diptera, family Calliphoridae, species Lucilia sericata.

Consequently, it is obvious that pathophysiology of decomposition plays an important and determinative role in the barbiturates related deaths. Various causes of death due to phenobarbital intake (suicidal deaths, euthanasia, accidental overdose deaths and homicides) can easily be confused. Death investigation and forensic toxicology are not immune to misinterpretation, as a large degree of error can arouse from attempting to estimate antemortem drug concentrations based only on single postmortem measurements.

Phenobarbital, Suicide Model, Postmortem Redistribution

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